U Series 9 Family

ST3160022A

ST3120025A

ST380012A

Ultra ATA Interface Drives

Product Manual

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Revision status summary sheet

Revision	Date	Writer/PLM	Sheets Affected
Rev. A	01/28/03	L. Newman/J. Knight	All.
Rev. B	04/15/03	L. Newman/J. Knight	Page 24.
Rev. C	05/07/03	L. Newman/J. Knight	Pages 6, 27, 30-32, and 37-41.

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1.0 Introduction

This manual describes the functional, mechanical and interface specifications for the following Seagate® U Series 9® model drives:

- ST3160022A
- ST3120025A
- ST380012A

These drives provide the following key features:

- High instantaneous (burst) data transfer rates (up to 100 Mbytes per second) using Ultra DMA mode 5.
- Giant magnetoresistive (GMR) recording heads and EPRML technology, which provide the drives with increased areal density.
- State-of-the-art cache and on-the-fly error-correction algorithms.
- Full-track multiple-sector transfer capability without local processor intervention.
- Quiet operation.
- 350 Gs nonoperating shock.
- SeaTools diagnostic software performs a drive self-test that eliminates unnecessary drive returns.
- The 3D Defense System™, which includes Drive Defense, Data Defense, and Diagnostic Defense, offers the industry's most comprehensive protection for disc drives.
- Support for S.M.A.R.T. drive monitoring and reporting.
- Support for Read Multiple and Write Multiple commands.
- Support for autodetection of master/slave drives that use cable select (CSEL).

2.0 Drive specifications

Unless otherwise noted, all specifications are measured under ambient conditions, at 25°C, and nominal power. For convenience, the phrases *the drive* and *this drive* are used throughout this manual to indicate ST3160022A, ST3120025A, and ST380012A model drives.

2.1 Specification summary table

The specifications listed in this table are for quick reference. For details on specification measurement or definition, see the appropriate section of this manual.

Drive specification	**ST3160022A**	**ST3120025A**	**ST380012A**
Formatted Gbytes (512 bytes/sector)	160	120	80
Guaranteed sectors	312,581,808	234,441,648	156,301,488
Bytes per sector	512		
Default sectors per track	63		
Default read/write heads	16		
Default cylinders	16,383		
Physical read/write heads	4	3	2
Discs	2	2	1
Recording density BPI (bits/inch max)	595,000		
Track density TPI (tracks/inch max)	94,600		
Areal density (Mbits/inch^2 max)	56.3		
Sustained data transfer rate OD (Mbytes/sec)	48		
I/O data-transfer rate (Mbytes/sec max)	100		
ATA data-transfer modes supported	PIO modes 0–4 Multiword DMA modes 0–2 Ultra DMA modes 0–5		
Cache buffer	1 Mbytes		
Height (mm max)	26.035 mm (1.028 inches)		
Width (mm max)	101.6 mm (4.000 inches)		
Length (mm max)	146.99 mm (5.787 inches)		
Weight (typical)	635 grams (1.4 lb)		

Drive specification	ST3160022A	ST3120025A	ST380012A
Average latency (msec)	4.16		
Power-on to ready (sec typical)	10 sec		
Standby to ready (sec typical)	10 sec		
Startup current (typical) 12V (peak)	2.8 amps		
Track-to-track seek time (msec typical)	<1.0 (read), <1.2 (write)		
Average seek, read (msec typical)	8.5		
Average seek, write (msec typical)	9.5		
Seek power (typical)	12.5 watts		
Read/write power (typical)	12.0 watts		
Idle mode (typical)	7.5 watts		
Standby mode	0.9 watts (typical)		
Sleep mode	0.9 watts (typical)		
Voltage tolerance (including noise)	5V ± 5% 12V ± 10%		

Drive specification	ST3160022A	ST3120025A	ST380012A
Ambient temperature	0° to 60°C (operating) –40° to 70°C (nonoperating)		
Temperature gradient (°C per hour max)	20°C (operating) 30°C (nonoperating)		
Relative humidity	5% to 90% (operating) 5% to 95% (nonoperating)		
Relative humidity gradient	30% per hour max		
Wet bulb temperature (°C max)	30 (operating) 40 (nonoperating)		
Altitude, operating	–60.96 m to 3,048 m (–200 ft to 10,000+ ft)		
Altitude, nonoperating (below mean sea level, max)	–60.96 m to 12,192 m (–200 ft to 40,000+ ft)		
Shock, operating (Gs max at 2 msec)	63		
Shock, nonoperating (Gs max at 2 msec)	350 Gs		
Vibration, operating	0.5 Gs (0 to peak, 22–350 Hz)		
Vibration, nonoperating	5.0 Gs (0 to peak, 22–350 Hz)		
Drive acoustics Sound power (bels) Idle* Seek	 <2.5 (typical) 2.7 (max) 2.8 (typical) 3.0 (max)		
Nonrecoverable read errors	1 per 10^{14} bits read		
Mean time between failures (power-on hours)	600,000		
Service life	5 Years		
Contact start-stop cycles (25°C, 40% relative humidity)	50,000		

*During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

2.2 Formatted capacity

Model	Formatted capacity	Guaranteed sectors	Bytes per sector
ST3160022A	160 Gbytes	312,581,808	512
ST3120025A	120 Gbytes	234,441,648	512
ST380012A	80 Gbytes	156,301,488	512

2.2.1 LBA mode

When addressing these drives in LBA mode, all blocks (sectors) are consecutively numbered from 0 to *n–1,* where *n* is the number of guaranteed sectors as defined above.

See Section 4.1.2, "Identify Device command" (words 60-61 and 100-103) for additional information about 48-bit addressing support of drives with capacities over 137 Gbytes.

2.3 Default logical geometry

Cylinders	Read/write heads	Sectors per track
16,383	16	63

2.4 Physical organization

Model	Read/write heads	Number of discs
ST3160022A	4	2
ST3120025A	3	2
ST380012A	2	1

2.5 Recording and interface technology

Interface	ATA
Recording method	16/17 EPRML
Recording density BPI (bits/inch max)	595,000
Track density TPI (tracks/inch max)	94,600
Areal density (Mbits/inch^2 max)	56.3
Internal data-transfer rate OD (Mbytes/sec max)	85.4
Sustained data transfer rate OD (Mbytes/sec max)	48
I/O data-transfer rate (Mbytes/sec max)	100 (Ultra DMA mode 5)
Interleave	1:1
Cache buffer	1 Mbyte (1,024 kbytes)

2.6 Physical characteristics

Drive specification		
Maximum height	(mm) (inches)	26.035 1.028
Maximum width	(mm) (inches)	101.6 4.00
Maximum length	(mm) (inches)	146.99 5.787
Typical weight	(grams) (pounds)	635 1.4

2.7 Seek time

Seek measurements are taken with nominal power at 25°C ambient temperature. All times are measured using drive diagnostics. The specifications in the table below are defined as follows:

- Track-to-track seek time is an average of all possible single-track seeks in both directions.
- Average seek time is a true statistical random average of at least 5,000 measurements of seeks between random tracks, less overhead.

Typical seek times (msec)	Read	Write
Track-to-track	<1.0	<1.2
Average 2 discs 1 disc	 8.5 8.5	 9.5 9.5
Average latency:	4.16	4.16

Note. These drives are designed to consistently meet the seek times represented in this manual. Physical seeks, regardless of mode (such as track-to-track and average), are expected to meet or exceed the noted values. However, due to the manner in which these drives are formatted, benchmark tests that include command overhead or measure logical seeks may produce results that vary from these specifications.

2.8 Start/stop times

Power-on to Ready (sec)	10 (max)
Standby to Ready (sec)	10 (max)
Ready to spindle stop (sec)	20 (max)

2.9 Power specifications

The drive receives DC power (+5V or +12V) through a four-pin standard drive power connector.

2.9.1 Power consumption

Power requirements for the drives are listed in the table on page 10. Typical power measurements are based on an average of drives tested, under nominal conditions, using 5.0V and 12.0V input voltage at 25°C ambient temperature.

- **Spinup power**

  Spinup power is measured from the time of power-on to the time that the drive spindle reaches operating speed.

- **Seek mode**

  During seek mode, the read/write actuator arm moves toward a specific position on the disc surface and does not execute a read or write operation. Servo electronics are active. Seek mode power represents the worst-case power consumption, using only random seeks with read or write latency time. This mode is not typical and is provided for worst-case information.

- **Read/write power and current**

  Read/write power is measured with the heads on track, based on a 16-sector write followed by a 32-msec delay, then a 16-sector read followed by a 32-msec delay.

- **Operating power and current**

  Operating power is measured using 40 percent random seeks, 40 percent read/write mode (1 write for each 10 reads) and 20 percent drive idle mode.

- **Idle mode power**

  Idle mode power is measured with the drive up to speed, with servo electronics active and with the heads in a random track location.

- **Standby mode**

  During Standby mode, the drive accepts commands, but the drive is not spinning, and the servo and read/write electronics are in power-down mode.

Power dissipation (watts, ST3160022A, 2-disc)	**Average (watts, 25° C)**	**5V typ amps**	**12V typ amps**
Spinup	—	—	2.8 (peak)
Idle	7.5	0.482	0.424
Idle* (with offline activity)	9.3	0.587	0.530
Operating 40% r/w. 40% seek, 20% inop.	12.0	0.638	0.739
Seeking	12.5	0.412	0.870
Standby	0.900	0.144	0.015
Sleep	0.900	0.144	0.015

*During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

2.9.1.1 Typical current profile

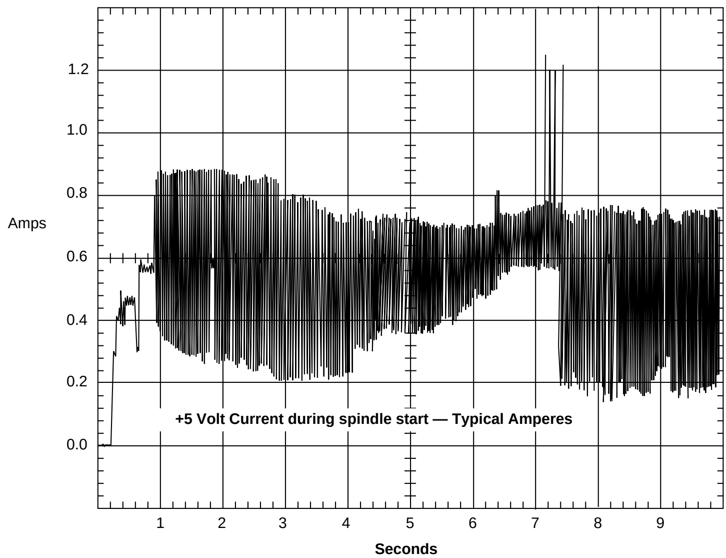


Figure 1. Typical 5V startup and operation current profile

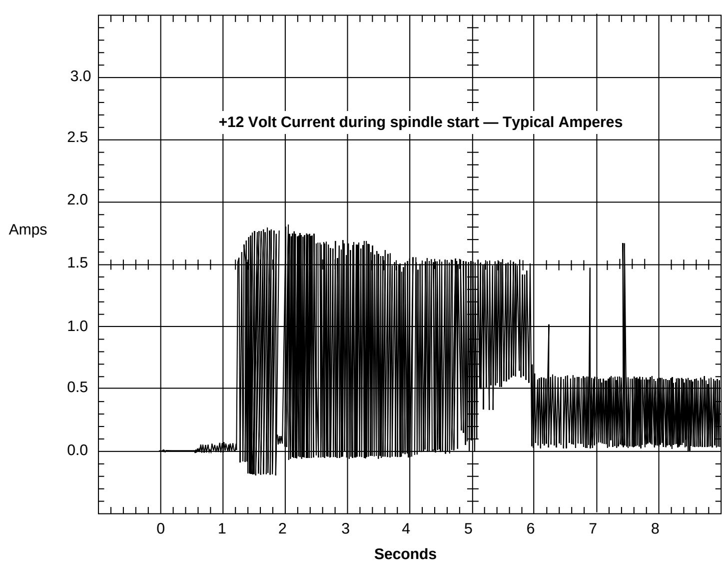


Figure 2. Typical 12V startup and operation current profile

2.9.2 Conducted noise

Input noise ripple is measured at the host system power supply across an equivalent 80-ohm resistive load on the +12 volt line or an equivalent 15-ohm resistive load on the +5 volt line.

- Using 12-volt power, the drive is expected to operate with a maximum of 120 mV peak-to-peak square-wave injected noise at up to 10 MHz.
- Using 5-volt power, the drive is expected to operate with a maximum of 100 mV peak-to-peak square-wave injected noise at up to 10 MHz.

Note. Equivalent resistance is calculated by dividing the nominal voltage by the typical RMS read/write current.

2.9.3 Voltage tolerance

Voltage tolerance (including noise):

5V ± 5%

12V ± 10%

2.9.4 Power-management modes

The drive provides programmable power management to provide greater energy efficiency. In most systems, you can control power management through the system setup program. The drive features the following power-management modes:

Power modes	**Heads**	**Spindle**	**Buffer**
Active	Tracking	Rotating	Enabled
Idle	Tracking	Rotating	Enabled
Standby	Parked	Stopped	Enabled
Sleep	Parked	Stopped	Disabled

- Active mode

  The drive is in Active mode during the read/write and seek operations.

- Idle mode

  The buffer remains enabled, and the drive accepts all commands and returns to Active mode any time disc access is necessary.

- Standby mode

  The drive enters Standby mode when the host sends a Standby Immediate

command. If the host has set the standby timer, the drive can also enter Standby mode automatically after the drive has been inactive for a specifiable length of time. The standby timer delay is established using a Standby or Idle command. In Standby mode, the drive buffer is enabled, the heads are parked and the spindle is at rest. The drive accepts all commands and returns to Active mode any time disc access is necessary.

- Sleep mode

  The drive enters Sleep mode after receiving a Sleep command from the host. In Sleep mode, the drive buffer is disabled, the heads are parked and the spindle is at rest. The drive leaves Sleep mode after it receives a Hard Reset or Soft Reset from the host. After receiving a reset, the drive exits Sleep mode and enters Standby mode with all current translation parameters intact.

- Idle and Standby timers

  Each time the drive performs an Active function (read, write or seek), the standby timer is reinitialized and begins counting down from its specified delay times to zero. If the standby timer reaches zero before any drive activity is required, the drive makes a transition to Standby mode. In both Idle and Standby mode, the drive accepts all commands and returns to Active mode when disc access is necessary.

2.10 Environmental specifications

2.10.1 Ambient temperature

Ambient temperature is defined as the temperature of the environment immediately surrounding the drive. Actual drive case temperature should not exceed 69°C (156°F) within the operating ambient conditions.

Above 1,000 feet (305 meters), the maximum temperature is derated linearly to 112°F (44°C) at 10,000 feet (3,048 meters).

Operating:	0° to 60°C (32° to 140°F)
Nonoperating:	–40° to 70°C (–40° to 158°F)

2.10.2 Temperature gradient

Operating:	20°C per hour (68°F per hour max), without condensation
Nonoperating:	30°C per hour (86°F per hour max)

2.10.3 Humidity

2.10.3.1 Relative humidity

Operating:	5% to 90% noncondensing (30% per hour max)
Nonoperating:	5% to 95% noncondensing (30% per hour max)

2.10.3.2 Wet bulb temperature

Operating:	30°C (86°F max)
Nonoperating:	40.0°C (104°F max)

2.10.4 Altitude

Operating:	–60.96 m to 3,048 m (–200 ft to 10,000+ ft)
Nonoperating:	–60.96 m to 12,192 m (–200 ft to 40,000+ ft)

2.10.5 Shock

All shock specifications assume that the drive is mounted securely with the input shock applied at the drive mounting screws. Shock may be applied in the X, Y or Z axis.

2.10.5.1 Operating shock

These drives comply with the performance levels specified in this document when subjected to a maximum operating shock of 63 Gs based on half-sine shock pulses of 2 msec. Shocks should not be repeated more than two times per second.

2.10.5.2 Nonoperating shock

The nonoperating shock level that the drive can experience without incurring physical damage or degradation in performance when subsequently put into operation is 350 Gs based on a nonrepetitive half-sine shock pulse of 2 msec duration.

2.10.6 Vibration

All vibration specifications assume that the drive is mounted securely with the input vibration applied at the drive mounting screws. Vibration may be applied in the X, Y or Z axis.

2.10.6.1 Operating vibration

The following table lists the maximum vibration levels that the drive may experience while meeting the performance standards specified in this document.

5–22 Hz	0.25-inch displacement (zero to peak)
22–350 Hz	0.5 Gs acceleration (zero to peak)

2.10.6.2 Nonoperating vibration

The following table lists the maximum nonoperating vibration that the drive may experience without incurring physical damage or degradation in performance when subsequently put into operation.

5–22 Hz	1.0-inch displacement (zero to peak)
22–350 Hz	5.0 Gs acceleration (zero to peak)

2.11 Acoustics

Drive acoustics are measured as overall A-weighted acoustic sound power levels (no pure tones). All measurements are consistent with ISO document 7779. Sound power measurements are taken under essentially free-field conditions over a reflecting plane. For all tests, the drive is oriented with the cover facing upward.

Note. For seek mode tests, the drive is placed in seek mode only. The number of seeks per second is defined by the following equation:

(Number of seeks per second = 0.4 / (average latency + average access time)

Table 1: Fluid Dynamic Bearing (FDB) motor acoustics

Models	Idle*	Seek
ST3160022A ST3120025A ST380012A	<2.5 bels (typ) 2.7 bels (max)	2.8 bels (typ) 3.0 bels (max)

*During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

2.12 Electromagnetic immunity

When properly installed in a representative host system, the drive operates without errors or degradation in performance when subjected to the radio frequency (RF) environments defined in the following table:

Test	Description	Performance level	Reference standard
Electrostatic discharge	Contact, HCP, VCP: ± 4 kV; Air: ± 8 kV	B	EN 61000-4-2: 95
Radiated RF immunity	80 to 1,000 MHz, 3 V/m, 80% AM with 1 kHz sine 900 MHz, 3 V/m, 50% pulse modulation @ 200 Hz	A	EN 61000-4-3: 96 ENV 50204: 95
Electrical fast transient	± 1 kV on AC mains, ± 0.5 kV on external I/O	B	EN 61000-4-4: 95
Surge immunity	± 1 kV differential, ± 2 kV common, AC mains	B	EN 61000-4-5: 95
Conducted RF immunity	150 kHz to 80 MHz, 3 Vrms, 80% AM with 1 kHz sine	A	EN 61000-4-6: 97
Voltage dips, interrupts	0% open, 5 seconds 0% short, 5 seconds 40%, 0.10 seconds 70%, 0.01 seconds	C C C B	EN 61000-4-11: 94

2.13 Reliability

Nonrecoverable read errors	1 per 10^{14} bits read, max.
Mean time between failures	600,000 power-on hours (nominal power, 25°C ambient temperature)
Contact start-stop cycles	50,000 cycles (at nominal voltage and temperature, with 60 cycles per hour and a 50% duty cycle)
Service Life	5 Years
Preventive maintenance	None required

2.14 Agency certification

2.14.1 Safety certification

The drives are recognized in accordance with UL 1950 and CSA C22.2 (950) and meet all applicable sections of IEC950 and EN 60950 as tested by TUV North America.

2.14.2 Electromagnetic compatibility

Hard drives that display the CE mark comply with the European Union (EU) requirements specified in the Electromagnetic Compatibility Directive (89/336/EEC). Testing is performed to the levels specified by the product standards for Information Technology Equipment (ITE). Emission levels are defined by EN 55022, Class B and the immunity levels are defined by EN 55024.

Seagate uses an independent laboratory to confirm compliance with the EC directives specified in the previous paragraph. Drives are tested in representative end-user systems. Although CE-marked Seagate drives comply with the directives when used in the test systems, we cannot guarantee that all systems will comply with the directives. The drive is designed for operation inside a properly designed enclosure, with properly shielded I/O cable (if necessary) and terminators on all unused I/O ports. Computer manufacturers and system integrators should confirm EMC compliance and provide CE marking for their products.

Korean RRL

If these drives have the Korea Ministry of Information and Communication (MIC) logo, they comply with paragraph 1 of Article 11 of the Electromagnetic Compatibility control Regulation and meet the Electromagnetic Compatibility (EMC) Framework requirements of the Radio Research Laboratory (RRL) Ministry of Information and Communication Republic of Korea.

These drives have been tested and comply with the Electromagnetic Interference/Electromagnetic Susceptibility (EMI/EMS) for Class B products. Drives are tested in a representative, end-user system by a Korean-recognized lab.

- EUT name (model numbers): ST3160022A, ST3120025A, and ST380012A
- Certificate numbers:

ST3160022A	E-H011-03-0085 (B)
ST3120025A	E-H011-03-0087 (B)
ST380012A	E-H011-03-0084 (B)

- Trade name or applicant: Seagate Technology
- Manufacturing date: January 2003
- Manufacturer/nationality: Singapore and China

Australian C-Tick (N176)

If these models have the C-Tick marking, they comply with the Australia/New Zealand Standard AS/NZS3548 1995 and meet the Electromagnetic Compatibility (EMC) Framework requirements of the Australian Communication Authority (ACA).

2.14.3 FCC verification

These drives are intended to be contained solely within a personal computer or similar enclosure (not attached as an external device). As such, each drive is considered to be a subassembly even when it is individually marketed to the customer. As a subassembly, no Federal Communications Commission verification or certification of the device is required.

Seagate Technology LLC has tested this device in enclosures as described above to ensure that the total assembly (enclosure, disc drive, motherboard, power supply, etc.) does comply with the limits for a Class B computing device, pursuant to Subpart J, Part 15 of the FCC rules. Operation with noncertified assemblies is likely to result in interference to radio and television reception.

Radio and television interference. This equipment generates and uses radio frequency energy and if not installed and used in strict accordance with the manufacturer's instructions, may cause interference to radio and television reception.

This equipment is designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television, which can be determined by turning the equipment on and off, you are encouraged to try one or more of the following corrective measures:

- Reorient the receiving antenna.
- Move the device to one side or the other of the radio or TV.
- Move the device farther away from the radio or TV.
- Plug the computer into a different outlet so that the receiver and computer are on different branch outlets.

If necessary, you should consult your dealer or an experienced radio/television technician for additional suggestions. You may find helpful the following booklet prepared by the Federal Communications Commission: *How to Identify and Resolve Radio-Television Interference Problems*. This booklet is available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Refer to publication number 004-000-00345-4.

3.0 Configuring and mounting the drive

This section contains the specifications and instructions for configuring and mounting the drive.

3.1 Handling and static discharge precautions

After unpacking, and before installation, the drive may be exposed to potential handling and electrostatic discharge (ESD) hazards. Observe the following standard handling and static-discharge precautions:

Caution:

- The SeaShell™ replaces electrostatic discharge (ESD) bags. The SeaShell package is a shock-ribbed, transparent clamshell enclosure that limits a drive's exposure to ESD and also protects against external shocks and stresses. The design permits attaching cables, software loading and label/barcode scanning without removing the drive from the SeaShell. This minimizes handling damage. Keep the drive in the SeaShell package until you are ready for installation.
- Before handling the drive, put on a grounded wrist strap, or ground yourself frequently by touching the metal chassis of a computer that is plugged into a grounded outlet. Wear a grounded wrist strap throughout the entire installation procedure.
- Handle the drive by its edges or frame *only*.
- The drive is extremely fragile—handle it with care. Do not press down on the drive top cover.
- Always rest the drive on a padded, antistatic surface until you mount it in the computer.
- Do not touch the connector pins or the printed circuit board.
- Do not remove the factory-installed labels from the drive or cover them with additional labels. Removal voids the warranty. Some factory-installed labels contain information needed to service the drive. Other labels are used to seal out dirt and contamination.

3.2 Jumper settings

3.2.1 Master/slave configuration

The options jumper block shown in Figure 3 is used to configure the drive for operation. It is the 8-pin dual header between the interface connector and the power connector. Use the following settings to configure the drive as a master or a slave.

Master or single drive. The drive is configured at the factory for a master or single-drive operation with a jumper set on pins 7 and 8.

Drive as slave. Remove all jumpers.

Drive as master with a non-ATA-compatible slave.
Use this jumper setting *only* if the drive does not work as a master with no jumpers installed.

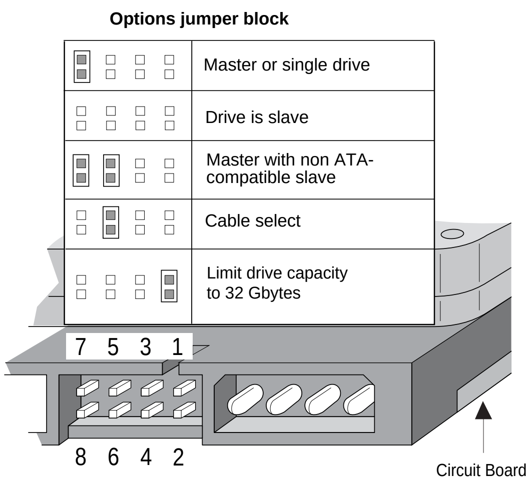


Figure 3. Master/slave jumper settings

3.2.2 Cable-select option

Computers that use cable select determine the master and slave drives by selecting or deselecting pin 28, CSEL, on the interface bus. Master and slave drives are determined by their physical position on the cable. To enable cable select, set a jumper on pins 5 and 6 as shown in Figure 3. Refer to your computer manual to determine whether your computer supports this option.

3.2.3 Alternate capacity jumper

Some older computers may “hang” at startup if their BIOS detects a disc drive with a capacity greater than 32 Gbytes. This limits the drive’s capacity to 32 Gbytes when the alternate capacity jumper is used. To access the full capacity of the drive, you can:

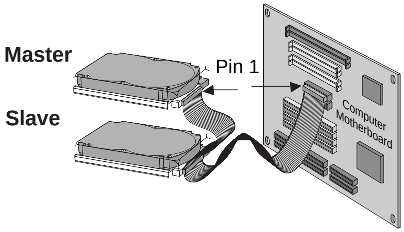
- Update the BIOS
- Use third-party software such as DiscWizard™ or Disk Manager
- Use a third-party host adapter

For drives with capacities greater than 32 Gbytes, the alternate capacity jumper changes the total available LBA sectors to 32 Gbytes to solve issues with some BIOS during power on. The ATA Set Features subcommand “$F1_H$ Report Full Capacity Available” causes Identify Data words 60 and 61 to report the full capacity. See Section 4.1.3 on page 33 for more details on the Set Features command.

Windows XP, Windows Me, Windows 98 or newer versions are needed to support drives with capacities greater than 32 Gbytes.

3.2.4 Ultra ATA/100 cable

An 80-conductor 40-pin cable is required to run Ultra DMA mode 3, mode 4 and mode 5. This cable uses even-numbered conductors connected to the ground pins to improve signal integrity.



Note. If you are using a 40-pin, 80-conductor cable, attach the blue connector to the motherboard, the black connector to the master drive, and the gray connector to the slave.

Figure 4. Ultra ATA cable connectors

Note. The drive supports both host and drive cable detection. The host detects the 80-conductor cable by sampling pin 34, CBLID–, on the interface bus. The drive detects the 80-conductor cable by sensing a capacitor at the host side through the CBLID– signal. The result is reported in a Fast Rise Detected bit (bit 13 of word 93 in the Identify drive parameter block).

3.3 Drive mounting

You can mount the drive in any orientation using four screws in the side-mounting holes or four screws in the bottom-mounting holes. See Figure 5 for drive mounting dimensions. Follow these important mounting precautions when mounting the drive:

- Allow a minimum clearance of 0.030 inches (0.76 mm) around the entire perimeter of the drive for cooling.
- Use only 6-32 UNC mounting screws.
- Do not overtighten the mounting screws (maximum torque: 6 inch-lb).
- Do not use a drive interface cable that is more than 18 inches long.

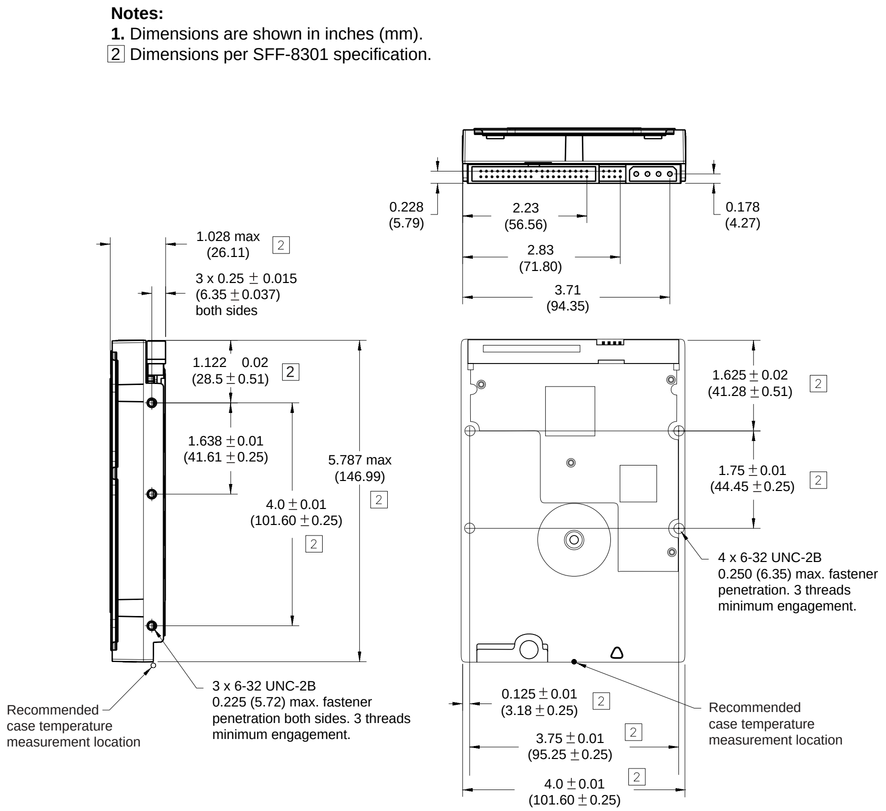


Figure 5. Mounting dimensions—top, side and end view

4.0 ATA interface

These drives use the industry-standard ATA task file interface that supports 16-bit data transfers. It supports ATA programmed input/output (PIO) modes 0–4; multiword DMA modes 0–2, and Ultra DMA modes 0–5. The drive also supports the use of the IORDY signal to provide reliable high-speed data transfers.

You can use a daisy-chain cable to connect two drives to a single AT host bus. For detailed information about the ATA interface, refer to the draft of *AT Attachment with Packet Interface Extension (ATA/ATAPI-6), NCITS T13 1410D,* subsequently referred to as the *Draft ATA-6 Standard*.

4.1 ATA interface signals and connector pins

Figure 6 on page 26 summarizes the signals on the ATA interface connector that the drive supports. For a detailed description of these signals, refer to the *Draft ATA-6 Standard.*

Drive pin #	Signal name	Host pin # and signal description
1	Reset–	1 Hardware Reset
2	Ground	2 Ground
3	DD7	3 Host Data Bus Bit 7
4	DD8	4 Host Data Bus Bit 8
5	DD6	5 Host Data Bus Bit 6
6	DD9	6 Host Data Bus Bit 9
7	DD5	7 Host Data Bus Bit 5
8	DD10	8 Host Data Bus Bit 10
9	DD4	9 Host Data Bus Bit 4
10	DD11	10 Host Data Bus Bit 11
11	DD3	11 Host Data Bus Bit 3
12	DD12	12 Host Data Bus Bit 12
13	DD2	13 Host Data Bus Bit 2
14	DD13	14 Host Data Bus Bit 13
15	DD1	15 Host Data Bus Bit 1
16	DD14	16 Host Data Bus Bit 14
17	DD0	17 Host Data Bus Bit 0
18	DD15	18 Device Data (15:0)
19	Ground	19 Ground
20	(removed)	20 (No Pin)
21	DMARQ	21 DMA Request
22	Ground	22 Ground
23	DIOW–	23 Device I/O Write:
	STOP	Stop Ultra DMA Burst
24	Ground	24 Ground
25	DIOR–	25 Device I/O Read:
	HDMARDY–	Host Ultra DMA Ready:
	HSTROBE	Host Ultra DMA Data Strobe
26	Ground	26 Ground
27	IORDY	27 I/O Channel Ready
	DDMARDY–	Device Ultra DMA Ready
	DSTROBE	Device Ulta DMA Data Strobe
28	CSEL	28 Cable Select
29	DMACK–	29 DMA Acknowledge
30	Ground	30 Ground
31	INTRQ	31 Device Interrupt
32	IOCS16–	32 Reserved
33	DA1	33 Host Address Bus Bit 1
34	PDIAG–	34 Passed Diagnostics
	CBLID–	Cable Assembly Type Identifier
35	DA0	35 Device Address (2:0)
36	DA2	36 Device Address (2:0)
37	CS0–	37 Chip Select (1:0)
38	CS1–	38 Chip Select (1:0)
39	DASP–	39 Drive Active/Slave Present
40	Ground	40 Ground

Pins 28, 34 and 39 are used for master-slave communication (details shown below).

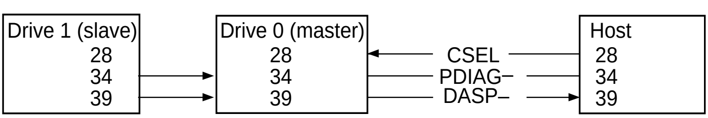


Figure 6. I/O pins and supported ATA signals

4.1.1 Supported ATA commands

The following table lists ATA-standard commands that the drive supports. For a detailed description of the ATA commands, refer to the *Draft ATA-6 Standard.* See “S.M.A.R.T. commands” on page 35 for details and subcommands used in the S.M.A.R.T. implementation.

Command name	Command code (in hex)
ATA-standard commands	
Download Microcode	92_H
Execute Device Diagnostics	90_H
Flush Cache	$E7_H$
Flush Cache Extended	EA_H
Identify Device	EC_H
Initialize Device Parameters	91_H
Read Buffer	$E4_H$
Read DMA	$C8_H$, $C9_H$
Read DMA Extended	25_H
Read Multiple	$C4_H$
Read Multiple Extended	29_H
Read Native Max Address	$F8_H$
Read Native Max Address Extended	27_H
Read Sectors	20_H, 21_H
Read Sectors Extended	24_H
Read Verify Sectors	40_H, 41_H
Read Verify Sectors Extended	42_H
Seek	70_H
Set Features	EF_H
Set Max Note: Individual Set Max commands are identified by the value placed in the Set Max Features register as defined to the right.	$F9_H$ Address: 00_H Password: 01_H Lock: 02_H Unlock: 03_H Freeze Lock: 04_H

Command name	Command code (in hex)
Set Multiple Mode	$C6_H$
S.M.A.R.T.	$B0_H$
Write Buffer	$E8_H$
Write DMA	$CA_{H,}$ CB_H
Write DMA Extended	35_H
Write Multiple	$C5_H$
Write Multiple Extended	39_H
Write Sectors	$30_{H,}$ 31_H
Write Sectors Extended	34_H
ATA-standard power-management commands	
Check Power Mode	98_H or $E5_H$
Idle	97_H or $E3_H$
Idle Immediate	95_H or $E1_H$
Sleep	99_H or $E6_H$
Standby	96_H or $E2_H$
Standby Immediate	94_H or $E0_H$
ATA-standard security commands	
Security Set Password	$F1_H$
Security Unlock	$F2_H$
Security Erase Prepare	$F3_H$
Security Erase Unit	$F4_H$
Security Freeze Lock	$F5_H$
Security Disable Password	$F6_H$

4.1.2 Identify Device command

The Identify Device command (command code EC_H) transfers information about the drive to the host following power up. The data is organized as a single 512-byte block of data, whose contents are shown in the table on page 27. All reserved bits or words should be set to zero. Parameters listed with an “x” are drive-specific or vary with the state of the drive. See Section 2.0 on page 3 for default parameter settings.

The following commands contain drive-specific features that may not be included in the *Draft ATA-6 Standard.*

Word	Description	Value
0	Configuration information: • Bit 15: 0 = ATA; 1 = ATAPI • Bit 7: removable media • Bit 6: removable controller • Bit 0: reserved	$0C5A_H$
1	Number of logical cylinders	16,383
2	ATA-reserved	0000_H
3	Number of logical heads	16
4	Retired	0000_H
5	Retired	0000_H
6	Number of logical sectors per logical track: 63	$003F_H$
7–9	Retired	0000_H
10–19	Serial number: (20 ASCII characters, 0000_H = none)	ASCII
20	Retired	0000_H
21	Retired	0400_H
22	Obsolete	0000_H
23–26	Firmware revision (8 ASCII character string, padded with blanks to end of string)	x.xx
27–46	Drive model number: (40 ASCII characters, padded with blanks to end of string)	ST3160022A ST3120025A ST380012A

Word	Description	Value
47	(Bits 7–0) Maximum sectors per interrupt on Read multiple and Write multiple (16)	8010_H
48	Reserved	0000_H
49	Standard Standby timer, IORDY supported and may be disabled	$2F00_H$
50	ATA-reserved	0000_H
51	PIO data-transfer cycle timing mode	0200_H
52	Retired	0200_H
53	Words 54–58, 64–70 and 88 are valid	0007_H
54	Number of current logical cylinders	$xxxx_H$
55	Number of current logical heads	$xxxx_H$
56	Number of current logical sectors per logical track	$xxxx_H$
57–58	Current capacity in sectors	$xxxx_H$
59	Number of sectors transferred during a Read Multiple or Write Multiple command	$xxxx_H$
60–61	Total number of user-addressable LBA sectors available (see Section 2.2 for related information) *Note: The maximum value allowed in this field is: 0FFFFFFFh (268,435,455 sectors, 137 Gbytes). Drives with capacities over 137 Gbytes will have 0FFFFFFFh in this field and the actual number of user-addressable LBAs specified in words 100-103. This is required for drives that support the 48-bit addressing feature.	ST3160022A =0FFFFFFFh* ST3120025A = 234,441,648 ST380012A = 156,301,488
62	Retired	0000_H
63	Multiword DMA active and modes supported (see note following this table)	$xx07_H$
64	Advanced PIO modes supported (modes 3 and 4 supported)	0003_H

Word	Description	Value
65	Minimum multiword DMA transfer cycle time per word (120 nsec)	0078_H
66	Recommended multiword DMA transfer cycle time per word (120 nsec)	0078_H
67	Minimum PIO cycle time without IORDY flow control (240 nsec)	$00F0_H$
68	Minimum PIO cycle time with IORDY flow control (120 nsec)	0078_H
69–74	ATA-reserved	0000_H
75	Queue depth	0000_H
76–79	ATA-reserved	0000_H
80	Major version number	$007E_H$
81	Minor version number	0000_H
82	Command sets supported	$346B_H$
83	Command sets supported	$7D01_H$
84	Command sets support extension	4003_H
85	Command sets enabled	$34xx_H$
86	Command sets enabled	$3xxx_H$
87	Command sets enable extension	4003_H
88	Ultra DMA support and current mode (see note following this table)	$xx3F_H$
89	Security erase time	0000_H
90	Enhanced security erase time	0000_H
92	Master password revision code	$FFFE_H$
93	Hardware reset value (see description following this table)	$xxxx_H$
95–99	ATA-reserved	0000_H

Word	Description	Value
100–103	Total number of user-addressable LBA sectors available (see Section 2.2 for related information) These words are required for drives that support the 48-bit addressing feature. Maximum value: 0000FFFFFFFFFFFFh.	ST3160022A = 312,581,808 ST3120025A = 234,441,648 ST380012A = 156,301,488
104–127	ATA-reserved	0000_H
128	Security status	0001_H
129–159	Seagate-reserved	$xxxx_H$
160–254	ATA-reserved	0000_H
255	Integrity word	$\mathrm{xxA5}_H$

Note. Advanced Power Management (APM) and Automatic Acoustic Management (AAM) features are not supported

Note. See the bit descriptions below for words 63, 88, and 93 of the Identify Drive data:

Description (if bit is set to 1)

Bit	Word 63
0	Multiword DMA mode 0 is supported.
1	Multiword DMA mode 1 is supported.
2	Multiword DMA mode 2 is supported.
8	Multiword DMA mode 0 is currently active.
9	Multiword DMA mode 1 is currently active.
10	Multiword DMA mode 2 is currently active.

Bit	Word 88
0	Ultra DMA mode 0 is supported.
1	Ultra DMA mode 1 is supported.
2	Ultra DMA mode 2 is supported.
3	Ultra DMA mode 3 is supported.
4	Ultra DMA mode 4 is supported.
8	Ultra DMA mode 0 is currently active.
9	Ultra DMA mode 1 is currently active.
10	Ultra DMA mode 2 is currently active.
11	Ultra DMA mode 3 is currently active.
12	Ultra DMA mode 4 is currently active.
13	Ultra DMA mode 5 is currently active.

Bit	Word 93
13	1 = 80-conductor cable detected, CBLID above V_{IH} 0 = 40-conductor cable detected, CBLID below V_{IL}

4.1.3 Set Features command

This command controls the implementation of various features that the drive supports. When the drive receives this command, it sets BSY, checks the contents of the Features register, clears BSY and generates an interrupt. If the

value in the register does not represent a feature that the drive supports, the command is aborted. Power-on default has the read look-ahead and write caching features enabled. The acceptable values for the Features register are defined as follows:

02_H Enable write cache *(default).*

03_H Set transfer mode (based on value in Sector Count register).

Sector Count register values:

- 00_H Set PIO mode to default (PIO mode 2).
- 01_H Set PIO mode to default and disable IORDY (PIO mode 2).
- 08_H PIO mode 0
- 09_H PIO mode 1
- $0A_H$ PIO mode 2
- $0B_H$ PIO mode 3
- $0C_H$ PIO mode 4 *(default)*
- 20_H Multiword DMA mode 0
- 21_H Multiword DMA mode 1
- 22_H Multiword DMA mode 2
- 40_H Ultra DMA mode 0
- 41_H Ultra DMA mode 1
- 42_H Ultra DMA mode 2
- 43_H Ultra DMA mode 3
- 44_H Ultra DMA mode 4
- 45_H Ultra DMA mode 5

55_H Disable read look-ahead (read cache) feature.

82_H Disable write cache.

AA_H Enable read look-ahead (read cache) feature *(default).*

$F1_H$ Report full capacity available

Note. At power-on, or after a hardware or software reset, the default values of the features are as indicated above.

4.1.4 S.M.A.R.T. commands

S.M.A.R.T. provides near-term failure prediction for disc drives. When S.M.A.R.T. is enabled, the drive monitors predetermined drive attributes that are susceptible to degradation over time. If self-monitoring determines that a failure is likely, S.M.A.R.T. makes a status report available to the host. Not all failures are predictable. S.M.A.R.T. predictability is limited to the attributes the drive can monitor. For more information on S.M.A.R.T. commands and implementation, see the *Draft ATA-6 Standard.*

SeaTools diagnostic software activates a built-in drive self-test (DST S.M.A.R.T. command for $D4_H$) that eliminates unnecessary drive returns. The diagnostic software ships with all new drives and is also available at: http://seatools.seagate.com.

This drive is shipped with S.M.A.R.T. features disabled. You must have a recent BIOS or software package that supports S.M.A.R.T. to enable this feature. The table below shows the S.M.A.R.T. command codes that the drive uses.

Code in features register	S.M.A.R.T. command
$D0_H$	S.M.A.R.T. Read Data
$D1_H$	Vendor-specific
$D2_H$	S.M.A.R.T. Enable/Disable Attribute Autosave
$D3_H$	S.M.A.R.T. Save Attribute Values
$D4_H$	S.M.A.R.T. Execute Off-line Immediate (runs DST)
$D5_H$	S.M.A.R.T. Read Log Sector
$D6_H$	S.M.A.R.T. Write Log Sector
$D7_H$	Vendor-specific
$D8_H$	S.M.A.R.T. Enable Operations
$D9_H$	S.M.A.R.T. Disable Operations
DA_H	S.M.A.R.T. Return Status

Note. If an appropriate code is not written to the Features Register, the command is aborted and 0*x*04 (abort) is written to the Error register.

5.0 Seagate Technology support services

Online Services

Internet

www.seagate.com for information about Seagate products and services. **rss.seagate.com** for information about Seagate backup tape drives and related services. Worldwide support is available 24 hours daily by e-mail for your disc or tape questions.

Presales Support:
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DiscPresales@Seagate.com
Tape: www.seagate.com/support/email/email_tape_presales.html *or*
Tape_Sales_Support@Seagate.com

Technical Support:
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Tape: www.seagate.com/support/email/email_tape_support.html *or*
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If you need help installing your drive, consult your system's documentation or contact the dealer's support services department for assistance specific to your system. Seagate technical support is also available to assist you online at support.seagate.com or through one of our technical support service centers. Have your system configuration information and your drive's “ST” model number available.

SeaTDD™ (+1-405-324-4725) is a telecommunications device for the deaf (TDD). You can send questions or comments 24 hours daily and exchange messages with a technical support specialist from 8:00 A.M. to 11:45 A.M. and 1:00 P.M. to 6:00 P.M. (Central time) Monday through Friday.

Warranty Service

Seagate offers worldwide customer support for Seagate drives. Seagate distributors, OEMs and other direct customers should contact their Seagate ser-

vice center representative for warranty-related issues. Resellers or end users of drive products should contact their place of purchase or one of the Seagate warranty service centers for assistance. Have your drive’s “ST” model number and serial number available.

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In some countries outside the US, you can contact an Authorized Service Center for service.

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Tape:	1-800-626-6637	+1-714-641-2500	+1-714-641-2410

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Warranty Service

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Canada			
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Brazil			
*MA Centro de Serviços**	—	+55-21-2509-7267	+55-21-2507-6672
		e-mail: centro.de.servicos.brasil@seagate.com	

*Authorized Service Centers
†For product-specific phone number

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Ireland	1 800-55 21 22
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Poland	00 800-311 12 38
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Hong Kong	800-90-0474	—	—
Hong Kong (Chinese)[1,3]	001-800-0830-1730	—	—
India[2,3]	1-600-33-1104	—	—
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[1]Hours of operation are 8:30 A.M. to 5:30 P.M., Monday through Friday (Australian Western time).

[2]Hours of operation are 9:00 A.M. to 6:00 P.M., Monday through Saturday.

[3]Authorized Service Center

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